

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Observation Skills/History of Forensics	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> • Define Observations • Describe examples of factors influencing eyewitness accounts of events • Compare the reliability of eyewitness testimony to what actually happened. • Relate observation skills to their use in forensic science. • Define Forensic Science. • Practice and improve your own observation skills 	<ul style="list-style-type: none"> • Define Forensic Science • What individuals have been involved in the development of forensic science? • What makes a good observation and what changes occur in the brain while observing? • What factors influence eyewitness accounts of events? • How reliable is eyewitness testimony to what actually happened? • How can an individual improve his/her observation skills?

Brief Unit Summary	Content Vocabulary
The skill of observation is critical to the field of forensic science. Sometimes a person is wrongly convicted of a crime because of faulty eyewitness testimony.	Analytical Skills, Deductive reasoning, Eyewitness, Fact, Forensic, Logical, Observations, Opinion, Perception, Motive, Means, Opportunity

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
DNA Genetic Code	Chapter Questions Quizzes/Test Completed Activities Labs/Activities: Dr. Henry Lee Website	Beginning of the year ~ 2 weeks

	<p>NYS Police Lab</p> <p>CSI Myths</p> <p>Biodetective Tapes: Histories Mysteries Wrongly Accused</p> <p>Innocenceproject.org – Roy Brown case</p> <p>Anthropometry Activity Will West v. William West</p> <p>Deadly Picnic</p> <p>Jane’s Restaurant</p> <p>You’re an eyewitness</p> <p>Youtube: Eyewitness</p> <p>What Influences our Observations Activity</p> <p>NPR.org – Forensic Artists Use Talent to Solve Crimes</p> <p>Facial Reconstruction DVD</p>	
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Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Crime Scene Investigation and Evidence Collection	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> ● Summarize Locard's Principle of Exchange. ● Identify examples of trace evidence. ● Distinguish between direct and circumstantial evidence. ● Identify the type of professionals who might be present at a crime scene. ● Summarize the seven steps of a crime-scene investigation. ● Explain the importance of securing the crime scene. ● Identify the method by which a crime scene is documented. ● Demonstrate proper technique in collecting and packaging trace evidence. ● Explain what it means to map a crime scene. ● Describe how evidence from a crime scene is analyzed. 	<ul style="list-style-type: none"> ● What is Locard's Principle of Exchange? ● What are examples of trace evidence? ● What is the difference between direct and circumstantial evidence? ● What are the seven steps of a crime-scene investigation? ● How is a crime scene documented? ● How is evidence collected and packaged? ● How is a crime scene mapped and analyzed? ●

Brief Unit Summary	Content Vocabulary
<p>A crime committed by a perpetrator will leave evidence at the scene, no matter how minute. Trace evidence can help investigators piece together details of a crime. Crime scenes need to be properly secured and collected and preserved.</p>	<ul style="list-style-type: none"> ● Chain of Custody ● Circumstantial Evidence ● Class Evidence ● Individual Evidence ● Crime-Scene investigation ● Crime-Scene Reconstruction ● Direct Evidence ● Primary Crime Scene ● Secondary Crime Scene ● Trace Evidence

Content Skills or Learning Targets		Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> • Blood Typing. • Different ways to study soil. • Calculating odds. • Chemical analysis of evidence. • 		<p>Chapter Questions</p> <p>Quizzes/Tests</p> <p>Labs/Activities:</p> <p>Locard's Principle of Exchange Lab</p> <p>Staged Crime Scene Investigation</p> <p>Student Activity – Documenting the Crime Scene</p> <p>Rough Sketch of Crime Scene</p> <p>Final Sketch of Crime Scene</p> <p>Crime Scene Search Activity</p> <p>Chain of Custody Procedure Activity</p> <p>Class vs. Individual Activity</p> <p>School Resource Officer (SRO)</p> <p>OJ Simpson Trial – Frontline Video</p> <p>Michael Boden Resource</p> <p>Final Sketches of Crime Scene</p>	3-5 weeks

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Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Physical Evidence/Soil and Glass Examination	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> Describe the distinguishing characteristics and compositions of different soils. Analyze soils using macroscopic and microscopic examination, as well as chemical and physical testing. Describe the effects of different physical and chemical compositions of soils on the decomposition of a corpse. Explain how soil analysis can link a suspect, victim, tool, or other evidence item to a crime scene. Summarize how to collect and document soil evidence. Describe the three major components of glass. Compare and contrast soda glass, lead glass (crystal), and heat-resistant glass. List and describe the physical properties of glass. Calculate the density of glass samples, Examine the refractive index of glass using the submersion method and Becke lines. Distinguish between radial and concentric fractures in terms of 	<ul style="list-style-type: none"> What are some distinguishing characteristics and compositions of different soils? How is soil analyzed using macroscopic and microscopic examination and chemical and physical testing? How can soil analysis link a suspect, victim, tool or other evidence item to a crime scene? How can soil profiles and different soil surfaces be used to locate a gravesite. How is soil evidence collected and documented? What are the three major components of glass? How do scientists compare and contrast soda glass, lead glass and heat-resistant glass? What are the physical properties of glass? How do scientists calculate the density of glass samples? How do scientists estimate the refractive index of glass using the submersion method and Becke lines?

<p>their appearance, how they are formed, and their location on fractured glass.</p> <ul style="list-style-type: none"> • Summarize and describe the information that can be gained by analyzing bullet hole(s) in fractured glass. • Compare and contrast laminated, tempered or safety glass, and bullet-resistant glass in terms of structure, use, and fracture pattern. • Describe how to properly collect and document glass evidence. • Summarize the ways to determine whether two glass fragments are consistent. 	<ul style="list-style-type: none"> • How are radial and concentric fractures formed and what is their location on fractured glass? • What information can be learned from analysis of bullet holes in fractured glass? • What are structural, use and fracture pattern differences between laminated, tempered or safety glass and bullet-resistant glass? • How is glass evidence collected and documented? • How do scientists determine whether two glass fragments are consistent? •
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Brief Unit Summary	Content Vocabulary
<p>Soil is the medium that supports plant growth. It is primarily made up of weathered rock, but also composed of air, water, and organic matter. Soil has three different textures that differ in size. Soil samples also differ in shape, color, and mineral composition. Each sample of soil has unique characteristics. Soil can be examined for its general texture and mineral and chemical composition.</p> <p>Most common forms of glass are considered to be class evidence because they are mass-produced. Specific properties of glass, such as density, refractive index, and fracture patterns, give investigators clues to help link a suspect to a crime scene.</p>	<ul style="list-style-type: none"> • Clay • Humus • Mineral • Sand • Sediment • Silt • Soil • Soil profile • Weathering • Amorphous • Backscatter • Bullet-resistant glass • Concentric Fracture • Density • Glass • Laminated glass • Normal Line • Radiating Fractures • Refraction • Refractive Index • Tempered Glass

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Content Skills or Learning Targets		Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> The components of different types of glass. Reflection and refraction; why fracture patterns form in glass, Snell's Law Calculation of density; solving equations for an unknown 		Chapter Questions	2-4 weeks
		Quizzes/Test	
		Labs/Activities:	
		Compare and Contrast Activities	
		Glass Fracture Pattern Analysis	
		Glass Density Lab	
		Approximating the Refractive Index of Glass Using a Submersion Test	
		Determining the Refractive Index of Liquids Using Snell's Law	

Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Organic and Inorganic Analysis	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> Describe the usefulness of trace elements for forensic comparison of various types of physical evidence. Define and distinguish protons, neutrons, and electrons Define and distinguish atomic number and atomic mass number. Explain the concept of an isotope. Understand how elements can be made radioactive. List the most useful examinations for performing a forensic comparison of paint. Distinguish continuous and line emission spectra. Understand the parts of a simple emission spectrograph. Appreciate the phenomenon of how an atom absorbs and releases energy in the form of light. Describe proper collection and preservation of forensic paint evidence. List the important forensic properties of soil. Describe proper collection of soil evidence. 	<ul style="list-style-type: none"> What are the three most important subatomic particles and their electrical charges, and indicate where each is located in the atom? How does an isotope impact radioactivity? What is the process of neutron activation analysis? What is the composition of paint and what forensic technology is used to identify the paint? What is the process of emission spectroscopy? How does an investigator handle trace evidence at the crime scene? How is soil evidence used in an investigation? What is matter made up of? What are Atoms, Elements and Molecules? What is Henry's Law and how does this apply to Forensic Science? What defines a trace element?

Brief Unit Summary	Content Vocabulary
For the criminalists, the presence of trace elements is particularly useful, because they provide "invisible" markers that may establish the source of a material or at least provide additional points for comparison.	Atomic number, atomic mass, beta ray, continuous spectrum, density-gradient tube, electron, emission spectrum, excited state, gamma ray, isotope, line spectrum, mineral neutron, nucleus, proton, pyrolysis, radioactivity, Henry's Law, Gas Chromatogram, Spectrophotometry

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
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Explain how chemistry is analyzed on trace evidence.	Organic Analysis Notes Inorganic Analysis Notes Chapter Questions Quizzes/Test Completed Activities Labs/Activities	~ 2 weeks
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Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Toxicology	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> ● Explain how alcohol is absorbed into the bloodstream, transported throughout the body, and eliminated by oxidation and excretion. ● Understand the process by which alcohol is excreted in the breath via the lungs. ● Understand the concepts of infrared and fuel cell breath-testing devices for alcohol testing. ● Describe commonly employed field sobriety tests to assess alcohol impairment. ● List and contrast laboratory procedures for measuring the concentration of alcohol in the blood. ● Relate the precautions to be taken to properly preserve blood in 	<ul style="list-style-type: none"> ● What are examples of drugs, poisons, and toxins? ● What factors affect drug toxicity? ● What is the role of a toxicologist in analyzing substance evidence? ● What is the difference between presumptive testing and confirmatory testing? ● How do people get exposed to environmental toxins and what are their effects on the body? ● What are the signs and symptoms of overdose with specific substances?

<p>order to analyze its alcohol content.</p> <ul style="list-style-type: none"> • Understand the significance of implied-consent laws and the Schmerber v Cal case to traffic enforcement. • Describe techniques that forensic toxicologists use to isolate and identify drugs and poisons. • Appreciate the significance of finding a drug in human tissues and organs to assess impairment. 	
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Brief Unit Summary	Content Vocabulary
<p>Toxicologists detect and identify drugs and poisons in body fluids, tissues, and organs. A major branch of forensic toxicology deals with the measurement of alcohol in the body for matters that pertain to violations of criminal law.</p>	<ul style="list-style-type: none"> • Addiction • Controlled substance • Controlled Substances Act • Depressant • Hallucinogen • Illegal Drug • Narcotic • Poison • Stimulant • Tolerance • Toxicity • Toxicology • Toxin • Alcohol • BAC • Absorption • Oxidation • Excretion • Breathalyzer • Field Sobriety • DRE

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> Effects of the human body. Components of drugs 	<p>Toxicology Notes</p> <p>WARD's Over the Counter Drug Lab (Drug Spot Test)</p> <p>Analysis of Famous People's drug overdoses</p> <p>Drugs Inc – National Geographic Video</p> <p>Drug Dog – Andy Kalet</p> <p>Blood Alcohol Concentration Lab</p> <p>SRO Lecture – DWI and ETOH</p> <p>Student presentations on Poisons</p>	~ 2 weeks

Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Hair Analysis	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> ● Identify the various parts of a hair. ● Describe variations in the structure of the medulla, cortex, and cuticle. ● Distinguish between human and nonhuman animal hair. ● Determine if two examples of hair are likely to be from the same person. Explain how hair can be used in a forensic investigation. ● Calculate the medullary index for a hair. ● Distinguish hairs from individuals belonging to broad racial categories. 	<ul style="list-style-type: none"> ● What are the parts of a Hair? ● What are variations in the structure of the medulla, cortex, and cuticle? ● How does one distinguish between human and nonhuman animal hair? ● How can hair be used in a forensic investigation? ● How can one distinguish hairs from individuals belonging to broad racial categories?

Brief Unit Summary	Content Vocabulary
<p>Hair varies in length and cross-sectional shape, depending on where on the body it originates. Some hair characteristics allow forensic experts to group hair evidence into categories that reflect ethnic background. Forensic experts examine hair using light and electron microscopy and analyze hair chemically for drugs and toxins.</p>	<ul style="list-style-type: none"> ● Comparison Microscope ● Cortex ● Cuticle ● Gas Chromatography ● Hair Follicle ● Hair Shaft ● Keratin ● Medulla ● Melanin Granules ● mtDNA ● Nuclear DNA

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
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<ul style="list-style-type: none"> • The structure and functions of human hair and hair of other mammals. • Using the properties of light and electron movement to analyze hair. • Calculating ratios and rates. 	Chapter Questions Quizzes/Test Completed Activities Labs/Activities -Human and non-human	~ 2 weeks
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Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Analysis of Threads and Fibers	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> • Identify and describe common weave patterns of textile samples. • Compare and contrast various types of fibers through physical and chemical analysis. • Describe principal characteristics of common fibers used in their identification. • Apply forensic science techniques to analyze fibers. 	<ul style="list-style-type: none"> • How can various types of fibers be compared and contrasted through physical and chemical analysis? • What are the physical characteristics of common fibers? • What techniques are used to analyze fibers?

Brief Unit Summary	Content Vocabulary
Fibers from clothing, hair, or the crime scene can be transferred from one person to another or discarded unnoticed at the crime scene. Fiber	<ul style="list-style-type: none"> • Amorphous

<p>type and weave pattern are important to forensic investigators. Unusual fibers on a suspect's clothing or belongings consistent with fibers belonging to a victim do not prove guilt but can link a suspect and a crime scene.</p>	<ul style="list-style-type: none"> ● Crystalline ● Direct Transfer ● Fiber ● Monomer ● Natural Fiber ● Polymer ● Secondary Transfer ● Synthetic Fiber ● Textile
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Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> ● Cellulose in plants; keratin in animals; plant morphology; microscopy ● Chemical analysis of fibers; burn tests; polymers. ● Reflection and refraction of light; wavelengths of the electromagnetic spectrum. ● Probability and statistics 	<p>Chapter Questions</p> <p>Quizzes and Tests</p> <p>Lab/Activities:</p> <p>Threads and Fiber Notes</p> <p>Microscopic Fiber Analysis Lab</p> <p>Bedsheet Thread Count Lab</p> <p>Weave Pattern Analysis Lab</p> <p>Textile Identification Lab</p> <p>Jollif Method Analysis</p> <p>Behavior of Burned Fibers Lab</p>	<p>1 week</p>

Differentiation/Enrichment	Materials	Resources
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Group Labs		
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Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Arson/Explosions	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<p>Arson</p> <ul style="list-style-type: none"> List the conditions necessary to initiate and sustain combustion. Understand the three mechanisms of heat transfer. Recognize the telltale signs of an accelerant-initiated fire. Describe how to collect physical evidence at the scene of a suspected arson. Describe laboratory procedures used to detect and identify hydrocarbon residues. <p>Explosions</p> <ul style="list-style-type: none"> Understand how explosives are classified. List some common commercial, homemade and military explosives. 	<p>Arson</p> <ul style="list-style-type: none"> Most arsons are initiated by petroleum distillates such as gasoline and kerosene. The GC is the most sensitive and reliable instrument for detecting and characterizing flammable residues. A GC separates the hydrocarbon components and produces a chromatographic pattern characteristic of a particular petroleum product. By Comparing select gas chromatographic peaks recovered from fire-scene debris to known flammable liquids, a forensic analyst may be able to identify the accelerant used to initiate the fire. Complex chromatographic patterns can be simplified by passing the separated components emerging from the GC column through a MS.

<ul style="list-style-type: none"> Describe how to collect physical evidence at the scene of an explosion. Describe laboratory procedures used to detect and identify explosive residues. 	<p>Explosions</p> <ul style="list-style-type: none"> Debris collected at explosion scenes is examined microscopically for unconsumed explosive particles. Recovered debris may be thoroughly rinsed with organic solvents and analyzed by testing procedures that include color spot tests, TLC, and GC/MS. Unconsumed explosives are identified by either infrared spectrophotometry or X-ray diffraction.
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Brief Unit Summary	Content Vocabulary
<p>When a fire occurs, oxygen combines with a fuel to produce noticeable quantities of heat and light. Three requirements must be satisfied to initiate and sustain combustion. The arson investigator must begin examining a fire scene for signs of arson as soon as the fire has been extinguished. In the laboratory, the gas chromatograph is the most sensitive and reliable instrument for detecting and characterizing flammable residues.</p>	<p>Arson: Accelerant, combustion, endothermic reaction, energy exothermic reaction, flammable range, flash point, heat of combustion, hydrocarbon, ignition temperature, modus operandi, Oxidation, pyrolysis, spontaneous combustion,</p> <p>Explosions: black powder, deflagration, detonating cord, Detonation, explosion, high explosive, low explosive, oxidizing agent, primary explosive, safety fuse, secondary explosive smokeless powder, X-ray diffraction</p>

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)
<p>Arson:</p> <ul style="list-style-type: none"> Explain what is oxidation. Explain how exothermic reactions differ from an endothermic reaction. Give examples of glowing combustion. List three requirements that must be satisfied to initiate and sustain combustion. List three common signs of arson at a fire scene. <p>Explosions:</p> <ul style="list-style-type: none"> Explain the difference between low explosives and high explosives. What is ANFO What makes up most detonators. Devices used most widely to screen objects for the presence of explosive residues. 	<p>Chapter Questions</p> <p>Quizzes/Test</p> <p>Completed Activities</p> <p>Labs/Activities</p>

- Procedures commonly used as screening tests for explosive residues.

Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Fingerprints	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> ● Know the common ridge characteristics of a fingerprint. ● List the three major fingerprint patterns and their respective subclasses. ● Distinguish visible, plastic, and latent fingerprints. ● Describe the concept of an automated fingerprint identification system (AFIS). ● List the techniques for developing latent fingerprints on porous and nonporous objects. ● Describe the proper procedures for preserving a developed latent fingerprint. 	Once a latent print has been visualized, it must be permanently preserved for future comparison and for possible use as court evidence.

Brief Unit Summary	Content Vocabulary
The ridges on our fingers in the shapes of loops, arches, and whorls are different from anyone else's. Fingerprint examiners look for unique	Anthropometry, Arch, digital imaging, Loresce,

characteristics, such as a core and deltas. Computer algorithms based on location of minutiae help to quickly sort fingerprints. There are three types of prints that might be found at a crime scene.	Iodine fungi, latent fingerprint, livescan, loop, ninhydrin, physical developer, Plastic print, ridge characteristics, minutiae, superglue fuming, visible print, whorl, ten card, ridge pattern,
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Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> The skin, fingerprints are formed in utero, fingerprints are different in identical twins. Powders and other chemicals used to recover fingerprints; skin oil can leave a fingerprint on a surface; chemical reactions can help lift latent fingerprints. Scanners and computers are used to collect and sort fingerprints; biometric technology 	Fingerprint Notes SRO training on collection of fingerprints Study your Fingerprints Lab Giant Balloon Fingerprint Activity Studying Latent and Plastic Fingerprints Lab How to Print a Ten Card Lab Fingerprint Analysis Activity Using Cyanoacrylate to Recover Latent Fingerprints	~ 2 weeks

Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Serology (Blood and blood spatter)	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> Describe the forensic significance of the different types of blood cells. Summarize the history of the use of blood and blood-spatter analysis in forensics. Outline the procedure used to determine blood type. Describe how to screen for the presence of human blood. Calculate the probability of a person having a specific blood type, using data from population studies. Describe the proper procedures for handling blood evidence. Analyze blood-spatter evidence using angle of impact, area of convergence and area of origin. Compare and contrast different types of blood-spatter patterns. Describe how different types of blood-spatter are formed. 	<ul style="list-style-type: none"> What is the forensic significance of the different types of blood cells? What is the history of the use of blood and blood-spatter analysis in forensics? Explain the procedure used to determine blood type. What technique is used to screen for the presence of human blood? What is the probability of a person having a specific blood type, using data from population studies? What is the proper procedure for handling blood evidence? How is blood-spatter evidence analyzed using angle of impact, area of convergence, and area of origin? What are the different types of blood-spatter patterns and how are they formed?

Brief Unit Summary	Content Vocabulary
<p>Blood consists mainly of three components suspended in a fluid called plasma. Blood typing and DNA profiling of bloodstains help to identify persons that were at a crime scene. Blood type, a form of class evidence, is determined by testing a sample for the presence of antigens. Blood-spatter patterns at crime scenes help investigators understand what happened at a crime scene. The size and shape of bloodstains, or blood spatter, provide clues as to how injuries occurred as well as what weapon was used to produce those injuries.</p>	<ul style="list-style-type: none"> Agglutination Angle of Impact Antibodies Antigen Antigen-antibody response Area of Convergence Area of Origin Cast-off Pattern Passive Drop Satellite Spine Swipe Wipe

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
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<ul style="list-style-type: none"> • Antigen-antibody reactions, blood types. • Chemical reactions used to discover blood evidence that may not otherwise be visible. • Effects of forces on blood - gravity, adhesion, cohesion, surface tension. • Calculating probability: using trigonometry to calculate origin of blood. 	Blood-Droplet Impact Angle Lab Area of Origin Lab Crime Scene Investigation Lab Quizzes, Exams	~ 2 weeks
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Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Entomology	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> • Describe several examples of the ways that forensic entomology is used to help solve crimes. • Compare and contrast the four stages of blowfly metamorphosis, and describe the significance of blowflies in forensic entomology. • Describe the function of each of the following organs on blowflies and explain the significance of each structure to forensic entomology: spiracles, mouth hooks and crop. • Describe the effect of different environmental factors on insect development. • Describe the five stages of decomposition. • Relate the process of insect succession to the changing 	<ul style="list-style-type: none"> • How is forensic entomology used to help solve crimes? • What are the four stages of blowfly metamorphosis and what is the significance of blowflies? • What is the effect of different environmental factors on insect development? • What are the five stages of decomposition? • What is the process of insect succession to the changing environment that occurs during the stages of decomposition? • How do entomologists interpret forensic evidence and environmental conditions to estimate a postmortem interval? • How is insect evidence analyzed to provide evidence of the deceased person's identity or drug, poison, or toxin exposure?

<p>environment that occurs during the stages of decomposition.</p> <ul style="list-style-type: none"> ● Explain how forensic entomologists interpret forensic evidence and environmental 	<ul style="list-style-type: none"> ● What are the procedures for documenting and collecting insect evidence from crime scenes?
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Brief Unit Summary	Content Vocabulary
<p>Forensic entomology plays an important role in solving crimes. Insect evidence can be used to establish postmortem intervals, identify the location of a crime scene, or link a suspect to a victim or crime scene. Proper evidence collection is required for insect evidence to be accepted in court.</p>	<ul style="list-style-type: none"> ● Accumulated degree hours (ADH) ● Complete Metamorphosis ● Entomology ● Forensic Entomology ● Grub ● Insect Succession ● Instar ● Larva ● Maggot ● Pupa

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> ● Life cycles of flies. ● Monitoring temperature variation. ● Calculating accumulated degree hours. 	<ul style="list-style-type: none"> ● Labs/Activities ● Observation of Blowflies or Houseflies Activities ● Factors Affecting Postmortem Interval Estimates and Accumulated Degree Hours Lab 	1 week

Differentiation/Enrichment	Materials	Resources
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Group Labs		
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Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Death: Manner, Mechanism, Cause	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> • Distinguish between cellular death and death of an organism. • Distinguish among four manners of death: natural, accidental, suicidal, and homicidal. Explain the fifth classification, undetermined. • Distinguish among cause, manner, and mechanism of death. • Outline the sequence of events that occurs in the first few minutes after death. • Explain how algor, rigor, and livor mortis develop following death and describe how their development is affected by environmental factors. • Sequence and describe the chemical and physical changes during decomposition, including autolysis, putrefaction, marbling and adipocere formation. • Analyze the evidence from algor, livor, and rigor mortis, stomach contents and decomposition, along with environmental 	<ul style="list-style-type: none"> • What is the difference between cellular death and death of an organism? • What are the four manners of death? • What is the difference between cause, manner and mechanism of death? • How do algor, rigor, and livor mortis develop following death? • What are the chemical and physical changes during decomposition? • What is the difference between medical examiners and coroners? • What is the procedure of an autopsy and how does it help to establish the cause of death, manner of death and postmortem interval? •

<p>factors to estimate a postmortem interval.</p> <ul style="list-style-type: none"> • Compare and contrast the roles of medical examiners and coroners. • Describe the procedures of an autopsy, and give examples of how an autopsy helps establish the cause of death, manner of death, and postmortem interval. • Support the claim that it is often difficult to pinpoint the postmortem interval. 	
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Brief Unit Summary	Content Vocabulary
<p>When a person dies under unknown or suspicious circumstances, a medical examiner determines the cause, manner and mechanism of death, along with providing an estimated postmortem interval. These are determined by examining evidence from the body, its location and the surrounding area.</p>	<ul style="list-style-type: none"> • Adipocere • Algor Mortis • Autolysis • Autopsy • Cause of Death • Coroner • Decomposition • Livor Mortis • Manner of Death • Mechanism of Death • Putrefaction • Rigor Mortis

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> • Medical definition of death; processes of bodily death; autolysis; physiology of muscle contraction, rigor mortis, livor mortis; factors affecting decomposition, autopsy procedures. • Anaerobic respiration; decomposition processes leading to marbling. 	<p>Chapter Questions</p> <p>Quizzes/Tests</p> <p>Activities: Death Notes</p> <p>Calculating Postmortem Interval Using Rigor Mortis Activity</p>	<p>1 week</p>

<ul style="list-style-type: none"> Heat loss by convection, conduction, and radiation (algor mortis). Calculation of PMI from algor mortis. 	Calculating Postmortem Interval Using Algor Mortis Activity Tommy the Tub Activity Analysis of Evidence from Death Scenes Activity WARDS Bone Lab	
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Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Tool Marks and Impressions	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> Provide examples of how impression evidence gives clues about the crime scene, person(s) at the scene, and events that occurred at the scene. Provide well-supported arguments that evidence such as foot, shoe, and dental impressions is usually considered class evidence. Distinguish among latent, patent, and plastic impressions. Summarize the significance of foot and shoe impression evidence, and outline procedures for collecting impression evidence from different types of surfaces. Compare and contrast skid marks, including how they are produced, when they are produced, what they look like and how they can be used to reconstruct events leading to a collision. 	<ul style="list-style-type: none"> How is evidence such as foot, shoe, and dental impressions, usually considered class evidence? What is the difference between latent, patent and plastic impressions? What are the features of tire impressions and skid marks used to help identify tire(s) or a vehicle's wheelbase, track width and/or turning diameter? How are skid marks produced, what do they look like and how can they be used to reconstruct events leading to a collision? What is the method used to produce an impression or cast? What are the three major types of tool marks and what types of tools produce those types of marks? What is the procedure for photographing, documenting, casting and collecting evidence from tools and tool marks?

<ul style="list-style-type: none"> ● Summarize the methods used to produce an impression or cast. ● Describe how forensic investigators analyze evidence from tools and tool marks to help solve crimes. ● Describe variations in tool surfaces that could be used to identify specific tools. ● Compare and contrast the three major types of tool marks and provide examples of tools that produce those types of marks. ● Provide examples of foreign materials found in tool marks, and elaborate on how this evidence can be used to link a suspect to a crime scene. ● Analyze and process a crime scene at which tools were used to commit the crime. ● Outline the sequence of procedures for photographing, documenting, casting and collecting evidence from tools and tool marks. 	
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Brief Unit Summary	Content Vocabulary
<p>There are three kinds of impressions: latent, patent, and plastic. Each kind of impression tells an important part of what happened at the scene of crime. Foot, shoe, and tire impressions can be collected.</p> <p>One of the most common kinds of physical evidence left at a crime scene is a tool mark. Tools develop unique characteristics that can be used to identify them. There are three major categories of tool marks: indentation marks, abrasion marks, and cutting marks. Careful observation of the b\crime scene, including examining tools or tool marks for foreign materials and fingerprints is essential. A cast may be made of the tool mark.</p>	<ul style="list-style-type: none"> ● Groove (of a tire) ● Latent Impression ● Patent Impression ● Plastic Impression ● Sole ● Track Width ● Tread ● Turning diameter ● Wheelbase ● Abrasion Mark ● Cutting Mark ● Indentation mark ● Tool Mark

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> • Size of feet versus height. • Friction • Table and graphs; diameter, radius circumference. • Tool marks on bone. • Chemical properties of magnesium, silicone casting material. • Measurement and scale: algorithms 	<ul style="list-style-type: none"> • Chapter Questions • Quizzes and Tests • Lab/Activities: • Tool Marks and Impression Notes • Making a Plaster of Paris Cast Lab • Shoe Size, Foot Size, and Height Activity • Tire Impressions and Analysis • Vehicle Identification Activity • Dental Impression Lab • Tool Marks: Screwdrivers and Chisels Lab • Hammers and Hammer Impressions Lab • Casting Impressions of Hammer Strikes on Wood in Silicone Lab 	1 week

Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	Firearms and Ballistics	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> ● Compare and contrast the different types of firearms, including handguns, rifles, and shotguns. ● Put in order the sequence of events that result in a firearm discharging. ● Estimate the trajectory of a projectile. ● Discuss the composition and formation of gunshot residue and its reliability as source of evidence. ● Compare and contrast entrance and exit wounds, including size, shape, gunshot residue, and the presence of burns. ● Distinguish among the various forms of firearms evidence, including rifling, markings on cartridges, marks on projectiles, and gunshot residue. ● Process and/or analyze a crime scene for firearm and ballistics evidence. 	<ul style="list-style-type: none"> ● What are the different types of firearms, including handguns, rifles and shotguns? ● How does a firearm discharge? ● How do forensic scientists estimate the trajectory of a projectile? ● What is the composition and formation of gunshot residue and how it plays a role as evidence? ● What is the difference between an entrance and an exit wound?

Brief Unit Summary	Content Vocabulary
<p>Modern firearms can be either long guns, such as rifles or shotguns, or handguns, such as revolvers and semi-automatics. Firearms fire projectiles, which, along with primer powder, gunpowder, and casing material, make up the cartridge. Bullets are classified by caliber, which is the measure of the inside of a rifled firearm and the diameter of the bullet. Each firearm leaves unique marking, or rifling marks, on bullets as they are fired. By calculating the bullet's trajectory, or path, an investigator may be able to trace the path of a bullet back to the location of the shooter.</p>	<ul style="list-style-type: none"> ● Ballistics ● Breech ● Bullet ● Caliber ● Cartridge ● Firearm ● Gunshot Residue (GSR) ● Lands and Grooves ● Pistol ● Revolver ● Rifle ● Rifling ● Trajectory

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> Gravity, projectile motion, velocity, trajectory, Measurement, diameter, solving proportion, Pythagorean theorem, trigonometry. 	<ul style="list-style-type: none"> Firearms and Ballistics Notes Bullet Trajectory Lab Firing Pin Analysis Lab Describing Spent Projectiles Lab How good is your aim? Lab 	1 week

Differentiation/Enrichment	Materials	Resources
Group Labs		

Subject and Grade:	Chem 108 (CCC Forensics)	School Year:	2023-2024
Unit Title:	DNA	Author/s:	Shaw

Objectives	Essential Question/Big Ideas
<ul style="list-style-type: none"> Explain how DNA can be important to criminal investigation. Explain how crime-scene evidence is collected for DNA analysis. Describe how crime-scene evidence is processed to obtain DNA. Explain what a short tandem repeat (STR) is, and explain its importance to DNA profiling. Explain how law-enforcement agencies compare new DNA evidence to existing DNA evidence. Describe the use of DNA profiling using mtDNA and Y STRs to help identify a person using the DNA of family members. Compare and contrast a gene and a chromosome, and an intron 	<ul style="list-style-type: none"> How is DNA important to criminal investigations? How and what crime scene evidence is collected and processed for DNA analysis? What are short tandem repeats (STR) and how are they important to DNA profiling? How do law-enforcement agencies compare new DNA evidence to existing DNA evidence? How is using mtDNA and Y STRs used to help identify a person using the DNA of family members?

and an exon.	
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Brief Unit Summary	Content Vocabulary
DNA is an important form of evidence that is used in criminal and civil investigations. From biological evidence such as saliva, blood, urine, or human remains, DNA can be isolated, amplified using PCR and analyzed. With advances in biotechnology and computer science, a more automated method of DNA analysis using STRs has improved both the accuracy and speed of analyzing DNA.	<ul style="list-style-type: none"> • Allele • Chromosome • CODIS • DNA Fingerprint • Electrophoresis • Intron • Karyotype • PCR • Polymorphism • Primer • Restriction enzyme • Restriction Fragment • Short Tandem Repeats

Content Skills or Learning Targets	Assessments (Pre-Assessments, Formative, and Summative)	Timeframe
<ul style="list-style-type: none"> • Function and structure of DNA. • Calculating probability. • Chemical composition of DNA and STRs, PCR reactions, restriction enzymes 	<ul style="list-style-type: none"> • Chapter Questions • Quizzes and Tests • Labs/Activities: • Chapter Notes • The Break-In Activity • Anna Anderson or Anastasia? STR Analysis Lab • STR Identification of a September 11 Victim Lab 	1 week

	<ul style="list-style-type: none"> • Identification of the Romanovs Using STR Profiling Lab 	
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Differentiation/Enrichment	Materials	Resources
Group Labs		